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Research Article

Selective Hydrogenation of Stearic Acid to 1-Octadecanol Using Bimetallic Palladium-Tin Supported on Carbon Catalysts at Mild Reaction Conditions

R. Rodiansono[1,2,*], Elisa Hayati[1], Atina Sabila Azzahra[1], Maria Dewi Astuti[1], Kamilia Mustikasari[1], Sadang Husain[2,3], S. Sutomo[4]

[1]Department of Chemistry, Faculty of Mathematics and Natural Sciences, Lambung Mangkurat University, Jl. A. Yani Km 36.0 Banjarbaru South Kalimantan, Indonesia.
[2]Catalysis for Sustainable Energy and Environment (CATSuRe), Lambung Mangkurat University, Indonesia.
[3]Department of Physics, Faculty of Mathematics and Natural Sciences, Lambung Mangkurat University, Jl. A. Yani Km 36 Banjarbaru, 70714, Indonesia.
[4]Department of Pharmacy, Faculty of Mathematics and Natural Sciences, Lambung Mangkurat University, Jl. A. Yani Km 36 Banjarbaru, 70714, Indonesia.

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Abstract

Bimetallic palladium-tin catalysts supported on microporous carbon (denoted as Pd-Sn(*x*)/C, loading amount of Pd = 5 wt% and *x* = Pd/Sn molar ratio; *c.a.* 3.0; 1.5; and 1.0) showed high selectivity in the hydrogenation of stearic acid towards 1-octadecanol (stearyl alcohol) under mild reaction conditions. Pd-Sn(*x*)/C catalysts were synthesized via the hydrothermal method at temperature of 150 °C for 24 h, and reduced with H_2 at 400 °C for 3 h. Pd-Sn(1.5)/C catalyst exhibited the highest yield of stearyl alcohol (1-octadecanol) (up to 73.2%) at 100% conversion of stearic acid at temperature 240 °C, initial H_2 pressure of 3.0 MPa, a reaction time of 13 h, and in 2-propanol/water solvent. The high selectivity of alcohols over Pd-Sn(1.5)/C catalyst can be attributed to the formation of bimetallic Pd-Sn alloy phases (*e.g.* Pd_3Sn and Pd_3Sn_2) as obviously depicted by XRD analysis. The presence of co-promotor Sn and the formation of bimetallic may play a pivotal role in the high selectivity of 1-octadecanol.

Keywords: hydrogenation; stearic acid; 1-octadecanol; bimetallic Pd-Sn catalyst

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1. Introduction

Fatty alcohols are non-ionic surfactants widely used as lubricants, emulsifiers, polymers, oil additives, emollients and thickeners in alimentary, cosmetic industries, and intermediate of biofuel synthesis [1]. Fatty alcohols can be produced from the catalytic hydrogenation of fatty acids using both heterogeneous and homogeneous catalysts is the important step in the transformation of biobased resources [2–7]. Commercially, the production of fatty alcohols involves methanolysis of triglycerides or fatty

* Corresponding Author.
Email: rodiansono@ulm.ac.id (R. Rodiansono);
Telp: +62-511-4773112, Fax: +62-511-4773112